TECHNICAL MEMORANDUM

Utah Coal Regulatory Program

April 14, 2009

TO: Internal File

FROM: Priscilla Burton, CPSSc, Team Lead, Environmental Scientist III PWB by SRS

RE: Test Plot Evaluation & Soil Monitoring Reports, West Ridge Resources, West Ridge Mine, C/007/0041, Task # 3111

SUMMARY:

The topsoil protection plan for the West Ridge Mine included the traditional stockpiling of topsoil from cut areas (12.25 acres), as well as an experimental practice of *in situ* burial and protection in fill areas (16.75 acres).

The experimental practice and test plots are described in Appendix 2-6. The hypothesis being tested is that the soil in and adjacent to the stream channel and in pockets of Rock Outcrop/Rubbleland that was covered by a layer of geotextile (or marker strips) and buried under fill will receive protection equivalent to burial within the middle of a large topsoil stockpile, but will also have greater stability at final reclamation than stockpiled and regraded topsoil, due to retained soil integrity provided by boulders, roots, and soil cementation remaining in tact. The retained structural integrity would reduce erosion in the stream channel and on adjacent slopes, enhancing reclamation success.

To text the hypothesis, experimental test plots were created in 1999 to simulate soil burial in place compared with soil stockpiling of two soil types. The test plots were "reclaimed" in 2005. Soils of the regraded test plots were analyzed shortly after regarding in 2005. A quantitative vegetative analysis of the reclaimed test plots was conducted in August 2008. In addition to the test plot, regular monitoring of the surface soils in three locations (T1, T2, T3) was required by the Division to ensure that buried soils would not be contaminated by activity on the surface during operations (Addendum 2000 to App. 2-6).

This review discusses the soil and vegetation analyses of the test plot as well as the recent soil monitoring of surface soils at points T1, T2, and T3.

TECHNICAL ANALYSIS:

REQUIREMENTS FOR PERMITS FOR SPECIAL CATEGORIES OF MINING

EXPERIMENTAL PRACTICES MINING

Regulatory Reference: 30 CFR Sec. 785.13; R645-302-210, -302-211, -302-212, -302-213, -302-214, -302-215, -302-216, -302-217, -302-218.

Analysis:

Test Plots

The Experimental Practice is described in Appendix 2-6. The experimental practice describes burial of topsoil for five years and subsequent unearthing and reclamation to compare soil chemistry and success of vegetative growth on the buried versus stockpiled topsoil. The experimental testplots are shown on Map 2-4. The eastern half of the plots (Strych Fill Area and Midfork Cut Area) represent the usual practice of salvaging, stockpiling and replacement of the topsoil (App. 2-6, p. 19) The western half of the plots represent topsoil burial to varying degrees.

In situ topsoil was buried under six feet of Midfork subsoil and one foot of Strych topsoil in the Strych Stockpile Area. This is the only plot that represents the experimental practice of burial and storage in place. A comparison of the Strych Stockpile Area and the Strych Fill area is the test of the conventional technique versus the experimental technique in the same soil type.

The in situ topsoil in the Midfork Stockpile Area plot was buried under only one foot of stockpiled Midfork topsoil. Since the surface two feet is generally considered to be active in a topsoil pile, this plot does not represent deeply buried topsoil.

A comparison of the Strych stockpile Area against the Strych Fill Area and the Midfork Cut Area tests the conventional technique in the Strych soil type against two other soil types.

A comparison of the Midfork Stockpile Area with the Midfork Cut Area represents the difference between topsoil salvage and handling as opposed to limited handling and shallow burial.

The test plots were reclaimed in September 2005 (refer to Inspection Report #737, dated September 6, 2005 for details). The work began with removing stinging nettle seed heads from a patch of nettle that completely covered the Midfork topsoil stockpile. Work proceeded as described in App. 2-6. Certified noxious weed-free Alfalfa hay was gouged into the regraded site (copy of certification was attached to the Inspection Report #717). The following field changes were made to Appendix 2-6:

1. There was no application of straw and wood fiber mulch tackifier.
2. There was no soil amendment added.
3. The seeding was completed on October 31, 2005 (email from Gary Gray 11/9/2005).
4. According to information received by 'fax' on September 10, 2005, the seed mix outlined in Table 3-2B was modified due to availability: Sandberg bluegrass replaced muttongrass (Poa fendleriana) and neither canyon sweetvetch nor rocky mountain maple were commercially available and were not included in the seed mix.
5. Containerized plants shown on Table 3-2B were not available and were not planted.
6. Visual observation of the percent cover of the vegetation on the test plots prior to regarding and reclamation of the plots indicated that a soil amendment would not be required to achieve vegetation success. The only suggestion made by the Division was to try to remove the stinging nettle seed heads from the Midfork Stockpile Area prior to removing the topsoil. This was accomplished.
7. Since no soil amendments were being added, soils were sampled and analyzed for fertility and other parameters to document status of soils after burial or storage and reclamation.

Soils were sampled after the testplots were regraded. One sample was taken from the center of each plot by Gary Gray, Environmental Coordinator for the West Ridge Mine. Brigham Young University Soil and Plant Analysis Lab completed the analyses on October 4, 2005. Although the analyses were cited in the January 2009 submittal under review, the laboratory analyses were not provided.

A vegetative analysis was conducted on August 15, 2008 with the following results.

Midfork Cut Plot: Total living cover = 76.5%. Dominant species: thickspike wheatgrass (*Elymus lanceolatus),* stinging nettle (*Urtica dioica).*

Midfork Stockpile: Total living cover = 79%. Dominant species: thickspike wheatgrass *(Elymus lanceolatus)*, Lewis flax (*Linum lewisii).*

Strych Stockpile: Total living cover = 63.5%, Dominant species: Lewis Flax *(Linum lewisii).*

Styrch Fill: Total living cover = 65%, Dominant species: Lewis Flax *(Linum lewisii),* Western wheatgrass *(Elymus smithii).*

The consultants report does not recognize the importance of the Strych Stockpile Area as the representative plot which demonstrates the test of conventional technique versus experimental technique in the same soil type. After six years of burial, it appears that there is no significant difference between the Strych stockpile and the Strych fill with regard to total living cover (63.5 and 65%, respectively).

After six years, the buried Strych soil (sample labeled Strych Stockpile Area) had a significant decline in total nitrogen and organic matter. The organic matter content of 2.89% was 60% less than the organic matter content of the stockpiled and replaced soil which was 4.56% (sample labeled Strych Fill Area). The total nitrogen reported was 502 ppm, about half of the figure reported for the stockpiled replaced soil (984 ppm). Curiously, the buried topsoil had greater nitrate nitrogen content (10%) than the stockpiled and replaced Strych topsoil (7%).

Other plant macronutrients phosphorus and potassium also declined in the buried soil, the SAR value doubled from 0.17 to 0.34, the bicarbonate/carbonate equilibrium appears to have altered and the pH increased slightly as a result, although it is difficult to draw too many conclusions with only one sample from each plot. Since there was little difference between vegetative cover in the two plots, one assumes that burial results in a slow reduction of favorable soil chemistry.

There was a noticeable difference in total living cover between the two soil types, Strych and Midfork, regardless of treatment (63.5 to 65% on Strych and 76.5-79% on Midfork soils). This difference may be accounted for by the greater nitrate nitrogen content of the stockpiled Midfork topsoil 16.8% compared with the stockpiled Strych topsoil 7.17% (represented by Midfork Cut Area and Strych Fill Area samples) and higher phosphorus (13.14 vs. 9.29 ppm). Moisture holding capacity of the Midfork soil (53%) was also greater than the Strych (31%), perhaps due to slightly higher organic matter, silt and clay contents.

Stinging nettle weed (*Urtica dioica)* pre-dominates in the Midfork Cut Plot. Many previous inspections of the test plots confirm that the stinging nettle was directly transferred in the topsoil from the Midfork Stockpile (where is grew out of control) to the Midfork Midfork Cut plot through propagules and seeds in the topsoil.

Addendum 2000 to Appendix 2-6, Soil Sampling at T1, T2 and T3

Page 2 of the Addendum 2000 to Appendix 2-6 describes annual soil monitoring of the surface fill to ensure protection of the buried soil resource. Approximate soil sample locations are shown on Map 2-1 of the MRP and Figure 1 of the 2008 consultants report. Sampled sites are not exactly the same location from year to year.

An annual sampling program has been difficult for the Permittee and Division to remember and the only results from 2001 and 2008 are currently available. [The Division's new practice of sending a commitment list along with the annual report form should help the Permittee remember this commitment to provide the soils testing results for sites T1, T2, T3 in the annual report.] The information provided from these two sampling episodes indicates that the mean pH remains the same, but there is evidence of increased salt loading and a corresponding elevated SAR value in the surface 6 – 12 inches. The Division agrees with the assumption that the elevated EC and SAR is due to road salting.

As shown on Map 2-5, the depth of fill in is approximately 10 feet at site T2 and 20 feet at sites T1 and T3. Sodium Adsorption Ratios and Electrical Conductivity at Sites T1 and T2 have doubled in seven years to values of 5.83 and 4 .14 respectively. But the SAR value at Site T3 (by the truck loading area) has really jumped from a value of 1.94 in 2001 to a value of 31.31 in 2008. The Permittee should evaluate road treatment options to reduce salt accumulation of roadside areas.

Findings:

The information provided in the report of Vegetation of the Experimental Test Plot 2008 does not provide enough information to the reviewer to present a current discussion of the experimental practice. Prior to approval, the following information must be provided in accordance with:

R645-301-121.100, The MRP Appendix 2-6 must be updated to state that the test plots were reclaimed in September 2005 (refer to Inspection Report #737, dated September 6, 2005 for details). The following field changes to the work described in Appendix 2-6 should be noted in Appendix 2-6 or in an addendum to App. 2-6:

1. The test plots were reclaimed in 2005, six years after their creation, not five as is stated in the consultant's report.
2. The work began with removing stinging nettle seed heads from a patch of nettle that completely covered the Midfork Stockpile Area.
3. Certified noxious weed-free Alfalfa hay was gouged into the regraded site (copy of certification was attached to the Inspection Report #717).
4. There was no application of straw and wood fiber mulch tackifier.

5. There was no soil amendment added based upon visual observation of vegetative cover, but soil samples were taken to document the soil chemistry.
6. Soils were sampled from the testplots after they were regraded. The Brigham Young University Soil and Plant Analysis Lab analysis is dated October 4, 2005. The 2005 laboratory analyses must be provided.
7. The seeding was done on October 31, 2005.
8. According to information received by the Division on September 10, 2005, the seed mix outlined in Table 3-2B was modified due to availability: Sandberg bluegrass replaced muttongrass (Poa fendleriana) and neither canyon sweetvetch nor rocky mountain maple were commercially available and were not included in the seed mix.
9. Containerized plants shown on Table 3-2B were not available and not planted.
10. A vegetative analysis was conducted in August 2008 and results are presented in an addendum to Appendix 2-6.
11. A discussion of the predominance of stinging nettle in the Midfork Cut plot in the 2008 Mt. Nebo report should point out that the Midfork Stockpile Area (the source of the Midfork Cut topsoil) was covered with stinging nettle and the root propagules and seed were more than likely carried over with the soil.
12. The consultant's comparisons should recognize that the Strych Stockpile Area is the only plot that represents the experimental practice of burial and storage in place. A comparison of the Strych Stockpile Area and the Strych Fill area is the test of the conventional technique versus the experimental technique in the same soil type.
13. The Permittee should state whether Canyon Sweet Vetch was collected and seeded at the site. If so, the report should provide seed collection and/or storage information and a seeding date.

R645-301-121.300, The Permittee must file the annual soil sample analysis of T1, T2, and T3 with the annual report, as stated in the Addendum 2000 to Appendix 2-6.

RECOMMENDATIONS:

The vegetation analysis indicates that there is no significant difference between the experimental practice burial in-place soil treatment and the stockpiled/replaced topsoil. This amendment to Appendix 2-6 is not recommended for approval because there are several details of the reclamation practice that should be included with this amendment to the MRP.

An annual sampling program has been difficult for the Permittee and Division to remember. The Division's new practice of sending a commitment list along with the annual report form should help the Permittee remember this commitment to provide the soils testing results for sites T1, T2, T3 in the annual report. Based on soils analysis from the truck loop

location (T3), the Permittee should evaluate winter use of road salt and road treatment options to reduce salt accumulation of roadside areas.

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